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AVOCADO CULTURE IN FLORIDA

The avocado, often incorrectly called alligator pear, is a favorite dooryard fruit tree throughout tropical America, and its commercial utilization in Florida and California is rapidly increasing. It is the purpose of this circular to answer briefly some of the questions most frequently asked relative to its culture, varieties, and possibilities in Florida.

The tree is normally a large rapid-growing evergreen of handsome appearance. The tree habit varies greatly with different varieties, from low and spreading (as Taft and Linda) to tall and slender (as Taylor and Lula).

The fruit also varies greatly in size, shape, and color, but frequently resembles a large green pear. It is eaten as a salad fruit and is greatly esteemed by all who are familiar with its qualities. From a dietetic standpoint the fruit is especially noteworthy for its high fat content, outranking in this respect all other fruits eaten in the fresh state. The oil content of mature fruit ranges from 10 to 25 percent in the varieties of the Guatemalan and Mexican races, with a somewhat lower percentage in the softer-fleshed West Indian varieties - 6 to 12 percent. It also outranks all other fresh fruits as a source of protein and is an important source of vitamins. Investigations have shown that the avocado contains all the vitamins from A to E, vitamin C (the antiscorbutic vitamin) being the only one not found in liberal quantities, though it is also present.

The Florida crop was formerly gathered from scattered seedling trees and consumed locally, but the growing demand for the fruit in the northern markets and the increasing knowledge of proper methods of propagation and culture have resulted within the last 15 years in the planting of several thousand acres of budded avocado orchards. About 30 years ago it was realized that seedling trees were extremely variable, and the practice of budding from superior parent trees began. The first two varieties thus disseminated were the Pollock and Trapp, still important West Indian varieties. The first avocado nursery was established in 1900 by George B. Cellon at Miami, Florida to whom belongs credit for introducing these two budded varieties.

From a succession of storms and floods, notably in 1926 and 1929, there was a heavy loss in acreage, so that there were probably about 2,500 acres in avocado orchards in Florida in 1933. Most of this acreage is located in the extreme southeastern tip of the State, in the southern part of Dade County. Some promising plantings have also been made in Highlands and Polk Counties and in favored locations along the east and west coasts as far north as Vero Beach and Clearwater. Some planting is also going on in drained portions of the Everglades near Lake Okeechobee.

An even more rapid expansion is taking place in California. From present indications however, the bulk of the California product will be ready for market in the winter, spring, and summer months, while the varieties most favored for Florida planting will furnish fruit during the fall and early winter months.

In both Florida and California the industry is so new that knowledge of the requirements and culture of this fruit is still far from complete.

VARIETIES

Perhaps the most important question to be settled by the prospective grower is the selection of the few best varieties to plant from the 100 or more sorts now available. As some of these have been very recently introduced and have borne but few seasons in Florida, it is not yet possible to make a definite list of recommended varieties. In any event, it should be well understood that no variety can be extensively planted with any safety in any locality until it has been thoroughly tested for that locality over a period of years. A variety may prove quite unsatisfactory in one locality, although well adapted to other nearby sections. While extensive plantings should be restricted to well-tested varieties and localities, small experimental plantings consisting of 2 or 3 trees each of the varieties that seem most promising for each particular locality should be encouraged. After 4 or 5 years, when the trees have borne two or three crops, the varieties that prove undesirable can be readily top-worked to the sorts that have proved most successful.

There is also strong evidence that varieties should be chosen for inter-planting that are adapted for "reciprocating" in the matter of pollination, most varieties being more or less self-sterile. This is because pollen is shed only on the second opening of the flower, at which time the pistil is usually past the receptive stage. The fact that all flowers act in unison on a single tree or other trees of the same variety makes it desirable that pollen should be available from nearby trees of some other variety having a different period for shedding pollen. This will be referred to later.

Avocado varieties may be conveniently grouped in three races, namely, West Indian, Guatemalan, and Mexican.

West Indian Race

All varieties of the West Indian race are comparatively tender to frost, withstanding even less cold than the common guava or the key lime. Their commercial culture, therefore, is restricted to the most tropical sections of the State, such as the localities immediately adjacent to the coast south of Vero Beach and Clearwater. Most of the land north of these points, and nearly all of the interior of the State, with the exception of a few unusually well protected localities, is too subject to frost for the safe planting of the West Indian varieties on a large scale. Small home plantings may be made with reasonable safety in localities somewhat colder than those mentioned, but in most of the colder localities the hardier Guatemalan and Mexican sorts will doubtless prove more desirable.

Among the most promising West Indian varieties are:

Trapp.-- Until recently this has been the leading commercial variety. Its season is September to November, a few fruits hanging on into December. The tree is usually prolific, but is lacking in vigor. The fruit is of large size, nearly round, smooth, yellowish green, with yellow flesh, and is excellent in quality. The variety is apparently self-fruitful to a large extent, i.e., not dependent on cross-pollination. New varieties of more vigorous habit and holding fruit into the winter months are gradually superseding the Trapp in popularity.

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Waldin.- The fruit somewhat resembles the Trapp in quality, but is oblong asymmetrical in shape, and slightly later in season. It is more thrifty than Trapp, especially on the rock-pine soils of the lower east coast; it is not so well adapted to sandy soils.

Pollock.- A summer and early fall fruit of large size, pear-shaped, green and of excellent quality. Usually not a heavy bearer, but is still occasionally planted for the early market and for a special trade.

Simmonds.- A seedling of the Pollock, which it resembles; thrifty and usually productive; fruit excellent in quality, maturing in summer. Simmonds and Pollock furnish good examples of "reciprocating" varieties, each serving, when growing close together, to assist fruit setting in the other. There is good reason to believe that low-producing groves of the Pollock avocados might be greatly benefited by top-working every third or fourth row to the Simmonds variety.

Fuchs.- A new variety especially noteworthy for its extreme earliness. Fruits of this variety are ready for market in June and July, before the heavy importations of the Cuban crop begin. The fruit is green, pear-shaped of medium size (12 to 16 ounces) and of fair to good quality. Considerable new acreage has recently been planted to the Fuchs variety in the Redlands district in the southern part of Dade county, where it originated.

Other West Indian varieties worthy of mention are Barker, Pinelli, Hardee, Butler, and McCann, the last named being chiefly grown in the Fort Myers section, where it originated.

Guatemalan Race

Varieties of the Guatemalan race, on account of their late season and relative hardiness, are now the center of interest among avocado growers. In contrast with the thin-skinned West Indian sorts, the Guatemalan varieties have fruits with thick, rough, or shell-like skins.. They vary greatly in quality, but the best varieties are considered equal in richness and flavor to the West Indian fruits.

In Florida the season of the Guatemalan varieties extends from October to May. They vary in hardiness, but will withstand from 3 to 5 degrees more of frost than the West Indian sorts. They are in no sense "frost proof" and average only about as hardy as the lemon. Although some of the most recent introductions may prove considerably hardier than any yet tested, until further evidence is at hand commercial plantings of Guatemalan avocados should be restricted to sections as free from killing frosts as are the highlands of Polk and Highland Counties. For home use the hardier sorts appear promising for trial in the most protected sections of Orange and Lake Counties and similar localities where lemons are grown in home gardens. However, with adequate equipment for grove heating their planting could be undertaken commercially throughout central Florida.

Among the 50 or more Guatemalan varieties tried out in Florida at different periods, the following have been given considerable attention:

Taft.- The season of Taft is from February to April. The fruit is oval, dull green, of good size, and of excellent quality. Because of uncertain bearing it is no longer regarded as promising for Florida.

Taylor.- The season of Taylor is from late December to March. The fruit is pear-shaped, rather small, green in color, quality fair to good. Several profitable groups have been harvested in Dade and Highlands Counties from mature trees of the Taylor variety, and its popularity is increasing. It is quite precocious and very upright in growth habit, requiring occasional heading back.

Wagner.- The fruit of this variety closely resembles the Taylor, the two being sister varieties originating as seedlings of the Royal. The fruit is about the size of the Taylor (10 to 16 ounces), but more rounded and smoother, of good quality, maturing January to March. The tree (like the Taylor) is fairly hardy but is less vigorous and less precocious than the Taylor, requiring about 4 years to come into fruiting. It differs in the tree habit from the Taylor, being rather low and spreading.

Eagle Rock.- A late winter-maturing variety bearing large-sized fruits, nearly round and of good quality. It is inclined to be shy in bearing under most conditions, but does fairly well in the Ridge section of south-central Florida.

Linda.- A variety of low-spreading tree habit, producing a large purplish fruit of roundish-oval shape, good quality, maturing as late as March or April. While the purple color is not in its favor, it has proved fairly profitable because of dependable production and late holding of the fruit. It is fairly hardy.

Schmidt.- A late variety (March and April) of thrifty growth, producing a large green fruit of good appearance and quality. Because of a tendency to shy bearing it is no longer favored for commercial planting.

Itzamma.- A late-maturing variety, February to April, producing a green, rounded-oval fruit of good market size (14 ounces) with fairly smooth rind and of excellent quality. Rather uncertain in bearing, but still under trial.

McDonald.- A very late-maturing fruit, nearly spherical, weighing from 12 to 14 ounces. Despite its rough, warty rind and almost black color when ripe, its good eating quality, hardiness, and productiveness have made it desirable for home plantings, though not commercially planted at present.

Other Guatemalan varieties that have fruited in Florida and are occasionally encountered are: Knight, Queen, Verde, Nimlioh, Benik, Lamat, Spinks, and Nabal.

Mexican Race

The leaves of all varieties of the Mexican race give off an anise scent when crushed in the hands. The Mexican varieties are also characterized by their relative hardiness. They are nearly as hardy as the round orange, and there are a few seedling trees that have fruited for years as far north as Gainesville. Some of the Mexican varieties bear fruits too small for shipping,

although excellent in quality. They may be recommended for trial as home-garden fruits in the northern citrus sections of Florida, where the West Indian and Guatemalan varieties are too tender.

However, some of the new Mexican varieties now being tested bear much larger fruits than the varieties of this race hitherto grown. As shipping fruits the Mexican varieties do not offer much promise for Florida, since they mature in the summer months when the larger and more attractive West Indian varieties are to be had. Not only is there competition with the Florida-produced West Indian varieties at this time, but the importations from Cuba are at their height during July, August, and September, resulting in low prices at that time.

Among the Mexican varieties that have been most commonly planted for trial are:

Gottfried.-- A variety originated and disseminated by the United States Plant Introduction Garden near Miami. The fruits ripen in August and September and are excellent in quality, weighing from 12 to 18 ounces, purplish maroon in color, rather uncertain in bearing, but occasionally producing heavy crops.

Puebla.-- A vigorous grower and fairly productive. The dark purple fruit, while a trifle small, is excellent in quality and large enough for market purposes. The season is late summer.

San Sebastian.-- Another Mexican variety of very thrifty growth habit, but which has been practically abandoned because of its shy bearing habits.

Hybrid Varieties

Hybrids between varieties of the different races are proving better adapted to Florida conditions than any of the introduced varieties thus far tried out. A few such hybrids are now being propagated on an extensive scale. Two of these hybrid varieties, Winslowson and Collinson, originated from seedlings developed at the United States Plant Introduction Garden near Miami. The former was first fruited out by P. H. Rolfs at Buena Vista, Fla.; the latter at the Plant Introduction Garden and also at Buena Vista.

Winslowson (also known as Rolfs).-- A seedling of Winslow, a Guatemalan-West Indian hybrid, very thrifty grower, producing large, nearly round, fine flavored, green fruit maturing from October to January. The tree is nearly as tender as the pure West Indian varieties. The fruit has proved disappointing in its shipping qualities, the flesh tending to turn dark around the seed when chilled or shipped under ice. The fruits also shed from the tree rather badly when nearing maturity, so that the popularity of the variety is on the wane, though the fruit is excellent for home use and local markets.

Collinson.-- A seedling of Collins, a Guatemalan-West Indian hybrid, maturing its attractive dark green, pear-shaped fruits from December to February. The tree and fruit are especially noteworthy for their resistance to scab. Since the flowers are unique in being devoid of pollen Collinson should be inter-planted with reciprocating varieties such as Winslowson, Linda, or Trapp, to facilitate fruit setting. The tree is somewhat harder than the West Indian varieties.

Lula.-- Believed to be a Guatemalan-Mexican hybrid originating as a seedling of the Taft. A thrifty, upright-growing tree, producing pear-shaped green

fruits of good quality, of medium size (16 to 20 ounces), maturing from December to February. This variety, despite its marked susceptibility to avocado scab, is proving a profitable producer. It is decidedly more hardy than other Florida-grown varieties, which recommends it for the central portions of the State. This variety was developed from a seedling grown by George B. Cellon of Miami, Florida.

Fuerte.- While often classed with the Guatemalan varieties, Fuerte is now conceded to be a Guatemalan-Mexican hybrid, originating in Mexico. The tree is vigorous and very hardy. The green pear-shaped fruit matures in Florida from December to March. It is excellent in quality when properly ripened, and the size is medium. Unfortunately, the fruit is very subject to "black spot," and trees will often drop almost an entire crop before the fruit reaches maturity. The remaining fruits do not ripen evenly, frequently developing hard spots in the flesh. This is the leading variety grown in California, but it appears to be poorly adapted to Florida conditions, especially in southern Florida. Because of its hardiness it may prove to have a place in home plantings in central and north-central portions of the State, but it is no longer planted commercially in Florida.

New Varieties Being Sought

Practically all of the varieties mentioned have one or more faults which interfere with securing the highest returns from the crop. Varieties which a few years ago brought a premium because of their large size are now at a discount because of the marked change in market demands. The rapid increase in production, particularly in California, has so cheapened avocados that they are now handled in quantity by numerous chain stores, where the demand is generally for a fruit of small size, from 10 to 16 ounces. The factor has operated to bring into prominence varieties (such as Taylor) formerly regarded as producing fruit too small for trade requirements. Furthermore, the severe competition offered by fall avocados imported at low price from Cuba has forced the practical abandonment of varieties maturing from August to October, formerly important shipping months for Florida avocado growers. To meet the need for fruit of small to medium size, fairly hardy and disease resistant, productive of good eating and shipping quality, and maturing at the right season, renewed efforts are being made to bring to light promising new varieties.

Where seedlings are grown from mixed variety plantings, a large proportion of the resulting plants are obvious hybrids, and among such hybrids some very promising new types have been selected and are being propagated for trial plantings.

Among those that may be mentioned as worthy of a place in trial plantings are the so-called Booth seedlings, the best of which for commercial purposes appear to be nos. 8, 7, and 3 (as yet unnamed), and one of the same group which has been named Ajax. Booth nos. 8, 7, and 3 are glossy-green fruited, of medium size, maturing respectively November, December, and January. The Ajax is probably too large for a shipping fruit, but its handsome appearance recommends it for local markets in the midwinter months. These varieties appear to be Guatemalan-West Indian hybrids and originated in the Booth orchards at Homestead, Florida.

The Dunedin, a seedling of the Winslow, meets all requirements as to size, color (green) and season of maturity, and is of fine flavor. It matures from January to March. It originated in the home grounds of L. B. Skinner at Dunedin, Florida.

The Nehrling, a seedling of the Collins, is a vigorous and apparently hardy hybrid (Guatemalan x West Indian) producing a fine-flavored green fruit, maturing during December and January at Orlando, where it originated at the home of Werner Nehrling. It may prove to be somewhat too large for an ideal shipping fruit but should be useful in supplying the local tourist trade in the winter months.

The Collinred A and Collinred B, two varieties originating at the United States Plant Introduction Garden, Coconut Grove, Florida, differ from most popular varieties in their color. The first named is a dull red, whereas the latter variety is a bright crimson (not turning to maroon) and is a most handsome and rich-flavored fruit of medium size, maturing in November and December.

Nirody, a variety originating as a hybrid of known parents (Pollock x Itzamna) matures its crop in October and November and is of good quality and medium size. The cross resulting in this Guatemalan-West Indian hybrid was made by B. S. Nirody, working under the supervision of the late W. J. Krome, at Homestead, Florida.

Tests of these and other varieties have not been carried on for a long enough period to make dependable predictions as to the outcome, but it is probable that the plantings of the near future will depend to a considerable degree on the result of observations now being made on these and similar new varieties of local seedling origin.

INTERPLANTING

The grouping of varieties has already been referred to as desirable to assist in flower pollination and fruit setting. All varieties thus far studied fall in two classes, which may be called class A and class B, the former having flowers ready to be pollinated in the forenoon but shedding pollen from a second set of flowers in the afternoon, the latter (class B) having a reverse flower behavior. Varieties of these two classes are listed in Table 1.

It will be readily seen that the varieties representing these two classes, if planted in adjoining rows, would be reciprocally benefited in the matter of pollination provided bees or other insects were active in carrying pollen from tree to tree.

It would also be necessary that the trees should have approximately the same blooming period. There is still much to be learned about the best grouping of varieties to bring about satisfactory conditions for fruiting, but a selected list of class A and class B varieties will serve to guard against making solid plantings of varieties that have the same flower behavior and that are therefore not capable of benefiting each other through cross-pollination.

Commercial plantings of recent years have been largely restricted to the following varieties (A or B following the name indicating its class as to pollination period): Fuchs (A), Pollock (B) Trapp (B), Waldin (A), Winslowson (B), Collinson (A), Lula (A), Taylor (A), Wagner (A), and Linda (B), listed in the order of fruit maturity.

Any new planting should include varieties selected from both of the above classes for interplanting. Where solid plantings of one variety (or varieties all of one class) have been made it may be necessary to top-work a portion of the trees to one or more reciprocating varieties before fruiting will be satisfactory. West Indian seedlings growing nearby may serve to effect cross-pollination in such plantings, since in any group of seedlings approximately 50 percent are found in each class, A and B. If possible, hives of bees should be placed in the orchards at blooming time to increase the chances for cross-pollination, since the agency of insects is a vital necessity in the transfer of pollen.

The occasional fruiting of isolated avocado trees is sometimes cited as evidence that cross-pollination is not a requirement for fruiting. Local and seasonal climatic conditions may have determining influence on self-fertility through the effect of temperature on the flower cycle. It has been noted, for instance, that the Fuerte variety during cool periods of weather (when the flowers have their "first open" period very late in the afternoon) usually carry their stigmas over night in a receptive condition. During the first part of the blooming period an isolated Fuerte tree may thus be fairly self-fruitful, but later when warm weather advances the time of flower opening to early or mid-afternoon, the stigma soon dries up and self-pollination cannot be effective when pollen is shed the following morning. With such a variety as the Fuerte a situation exposed to cool ocean breezes may cause the pollen flowers of the morning to continue dehiscing most of the afternoon, rendering possible the pollination of the first-period flowers opening during the afternoon hours. This factor operates to render the Fuerte variety largely self-fruitful in the coastal region of southern California. Such climatic factors may have much to do with the apparent adaptation of varieties in certain districts and their failure in others.

Close pollination may also occasionally result from the probing of flowers by insects in search of nectar, carrying pollen from open flowers shedding pollen to flowers on the same tree not yet open but about ready to open. Bees and other insects may occasionally carry pollen on their bodies long enough to bridge over the gap of an hour or two between the morning flowers with pollen and the afternoon set of open flowers with receptive stigmas (class B variety). However, the fact that in any large planting of avocado seedlings the distribution, as ascertained by careful investigation, is approximately 50 percent in each of the A and B groups (morning and afternoon pollinizers) furnishes convincing proof that the avocado is adapted by nature to be cross pollinated.

PROPAGATION

Seedling trees are seldom planted in Florida, because of their uncertain yield and variable quality. Avocados are usually propagated by shield budding. The method is similar to that use with citrus trees, although considerably more difficult in execution, requiring much closer attention to details for successful results. Mature seeds are sown in boxes, pots, or in the open ground with pointed end uppermost and barely covered by the soil. Two to four months after planting, when one-fourth to one-half inch in diameter, the seedlings are ready for budding, provided they are making vigorous growth and the bark slips easily. The bud wood should be selected by taking wood that is of recent growth but not so sappy that it will break when bent. The buds used should be plump, well developed, 1 to 2 inches in length. They should be cut smoothly with a very sharp, thin-edged knife. The usual T-shaped incision is made in the stock close to the ground and the bud is gently inserted, taking great care not to injure the delicate inner bark tissues. After the bud is inserted it should be firmly and

Table 1 - Selected List of Class A and Class B. Varieties

Class A	Class B
Atlixco	Booth No. 6
Barker	Booth No. 7
Benik	Booth No. 8
Blakeman	Colla
Booth No. 1	Collinred A
Brooks	Collins
Butler	Cook
Collinson	Dorothea
Collinred B	Eagle Rock
Dickinson	Fuerte
Dunedin	Hardee
Fuchs	Itzamna
Gottfried	Knight
Hawaii	Lamat
Ishkal	Linda
Kashlan	Lyon
Lula	McDonald
Mayapan	Meserve
McCann	Nabal
Perfecto	Nimlich
Peterson	Nirody
Pinelli	Panchoy
Puebla	Pollock
Sharpless	Queen
Simmonds	San Sebastian
Sinaloa	Schmidt
Solano	Steffani
Spinks	Stephen's Choice
Taft	Surprise
Taylor	Trapp
Wagner	Verde
Waldin	Winslow
	Winslowson (Rofls)

Note: Class A varieties have only first-period flowers (receptive) in the forenoon, second-period flowers shedding pollen in the afternoon. Class B varieties have only second-period flowers shedding pollen in the forenoon, first period (receptive) in the afternoon. This classification may be altered or reversed by sudden and violent weather changes but holds good for weather favorable to pollination and fruit setting.

snugly wrapped with waxed tape or raffia, leaving the eye exposed. Three to five weeks later, when the bud has united with the stock, this wrap may be loosened, but it should not be entirely removed until the bud sprout is an inch or so long. At the time of budding, the bark of the stock should be notched or partially girdled a few inches above the bud. When the bud sprout is 6 inches or more in length the old stock should be cut off cleanly and as close to the bud as possible.

Avocados may also be propagated by whip, saddle or cleft grafting and the latter method is now being used with considerable success on seedling sprouts while still quite tender and only of pencil size. Seeds can thus be germinated in a bed and bench grafted, then placed in boxes in which they are to be grown until set in a permanent place. Covering the graft union with melted paraffin is an important aid in securing success with this method. Because of the tender tissues of such young seedlings, rubber tissue such as is used by tailors is substituted for waxed cloth in this form of grafting. By the time the graft is healed on, the tissue disintegrates and is easily removed. This method reduces greatly the time necessary to grow the plants in boxes, thus diminishing the chances for "coiled roots" and generally weakened trees.

Old seedling trees bearing scanty or inferior crops can be top-worked to the best standard varieties. This is done by cutting half or more of the main limbs back to stubs in the late summer or fall. The following winter or early spring, vigorous sprouts appear from these stubs and when these sprouts are about an inch in diameter they are budded by the shield-budding method described above. The following season the remainder of the tree may be rebudded by the same process.

Successful results have also been secured with cleft-grafting old trees and this method is preferred by many growers. Cleft grafts can be used either in the main branches a few feet above the ground or placed in the main trunk close to the ground. The work should be done in the winter months and rather larger dormant bud wood should be selected for use as scions. To avoid excessive splitting, the cleft should be made with a saw to a depth of 3 or 4 inches and wedges driven in only far enough to start splitting. If necessary the sides of the cleft should be trimmed away with the grafting knife to fit the tapered end of the scion. To avoid excessive pressure on the scion, the wooden wedges should be only partly withdrawn, the exposed end being cut off flush with the end of the limb or trunk. The cut surface should be thoroughly waxed or paraffined, care being taken to fill completely the cleft opening.

The grafts should also be protected against drying out by a light coating of melted paraffin or other grafting wax and by providing a collar of building paper around the cut end of the tree or branch and keeping this filled with moist sawdust or clean sand.

For one skilled in budding and grafting and willing to devote the necessary time to the propagation work, one of the surest ways to get strong growing trees is to plant out young seedlings in place and do the budding (or grafting) when they are well established. This method requires expertness and close attention to detail.

SITES AND SOILS

In choosing a site for the avocado, select land with good air and water drainage. Low areas or pockets in which cold air might settle on frosty nights should be avoided. Land with poor water drainage is very objectionable. Sites exposed to

the wind should be protected by some sort of windbreak, as tropical storms often do much damage. A number of avocado orchards planted on low ocean keys have been severely injured by salt spray during strong winds as well as by flooding of salt water during exceptionally high tides. Lands subjected to much flooding in periods of heavy rainfall are likewise to be avoided as orchard sites.

The avocado can be successfully grown on a wide range of soils but does best on a rich, sandy loam. The porous rock-pine soil of the lower east coast where it contains sufficient humus and clay (as in the Redlands section) seems to be well suited to avocado growing. Hammock land soils and the best grade of high-pine lands when well drained are very satisfactory. Pine flatwoods lands are fairly good but are frequently too wet and subject to overflow during the rainy season. Very light soils such as the "scrub" pinelands of southern Florida are undesirable for avocados unless the grower is prepared to fertilize heavily and water his trees.

PLANTING METHODS

On medium light or rocky soils the trees should be planted about 20 by 20 feet apart; on richer soils a distance of 25 by 25 feet may be preferable. Planting may be done at any time of the year when good trees can be secured, although summer or early fall planting is usually preferred. Tree mounds should be prepared several weeks (or months) in advance of planting, by digging holes where the trees are to be placed and bedding in manure or other organic material in the prepared ground. Any hardpan should be thoroughly broken up. In the rock-pine soils of the lower east coast each hole should be prepared by dynamiting with small charges and the loose rocks removed, replacing with the finer topsoil when planting trees. Deep blasting or drastic scarification is undesirable, usually resulting in chlorotic trees due to setting free an excess of lime. The roots should be kept moist at all times during planting. When plants are received in boxes (as usually shipped out from nurseries) the box should be removed with great care so as not to injure or disturb the roots. The ball of earth should not be broken. The trees should be placed with the bud union slightly above the surface of the ground and the soil packed firmly down until it is in close contact with the roots.

The trees should be liberally watered at planting and rewatered at intervals until safely established. It is an excellent plan to mulch the ground about the newly set trees with hay, weeds, manure or other material that will keep the soil cool and moist. A mulch of this sort is almost essential to protect the surfact roots from the hot sun. It is well also to shade the trees during their first summer with a simple covering of lath and burlap. Thousands of valuable budded trees are lost each year in Florida because they are set out in the hot dry sand and left to shift for themselves. A little attention to watering, mulching and shading after the trees are planted will be well worthwhile.

An occasional application of Bordeaux mixture either as a spray or applied to the trunks in thin paste form is desirable as protection against the bark fungus which is often fatal to young trees.

During the first two winters the small trees are much more tender to cold than when older and larger. Mounding with clean sandy soil well above the bud union is often practiced as a protection against cold but is not a feasible method in heavy or rocky soils. Mounded trees should be inspected frequently to avoid injury to the bark from overheating or from insect attack. The use of wood fires or grove heaters burning coke, charcoal, or oil is the safest form of insurance against loss of trees or crop from a sudden visitation of cold.

CULTIVATION, MULCHING, AND COVER CROPS

Some methods of caring for the soil should be planned that will conserve moisture and fertility and add humus. Clean cultivation the year round has been found unsatisfactory as it destroys too much of the humus. Clean cultivation through the dry season, followed by the growing of cover crops in the summer rainy season, these to be turned into the ground in the fall, has given very good results in a number of avocado orchards. In others, a system of permanent mulching is used with excellent success. The ground beneath the trees, as far out as the roots extend, is kept mulched the year through with a covering of hay, seaweed, manure, or other material. Excellent mulching material is cheaply obtained in some groves by sowing velvet beans, pigeon peas, crotalaria, beggar-weed or Natal grass in the row middles, cutting these crops from time to time and adding the hay to the mulch beneath the trees.

FERTILIZING

Avocados are heavy feeders and should be well fertilized if one wishes to secure the best results. The amount of fertilizer to be applied will vary but as a general rule the trees should be fertilized four or five times the first year after planting, giving them at each application a pound of fertilizer containing about 5 percent of nitrogen, 6 or 7 percent of phosphoric acid and 3 or 4 percent of potash. This amount may be increased to 2 pounds per application in the second year and gradually increased until the trees reach full bearing size, when they should receive from 40 to 60 pounds annually.

The nitrogen used in the avocado fertilizers should be derived mostly from organic sources such as guano and tankage, rather than from nitrate of soda or other inorganic forms. Additional applications of stable manure or other fertilizer containing large amounts of organic nitrogen may be made with advantage. It is difficult to overfeed an avocado tree.

IRRIGATION

The avocado requires an abundant supply of water and should not be planted in very dry soils unless some system of irrigation is installed. Even in more favorable soils irrigation is highly desirable, as droughts are not infrequent in Florida.

PRUNING

Most varieties of avocados require but little pruning if properly headed at planting time. Later pruning will consist largely in removing weak or undesirable growth. A few varieties tend to grow very tall and these need occasional heading back to lessen the danger of wind damage and to facilitate spraying and harvesting operations.

INSECT PESTS AND FUNGUS DISEASES

Several insect pests and fungus diseases require the grower's attention but their control has been fairly well worked out. The red spider, which is especially injurious in dry weather, may be checked by spraying with commercial lime-sulphur solution (1-70) or with sulphur dust. Scale infestation and white fly, with the sooty mold that follows, call for the use of oil emulsion sprays (1-70) in the dormant season, November to February.

Avocado scab, affecting both fruit and foliage, and "black spot", affecting the fruit, are the most serious fungus troubles to be guarded against. They are usually controlled by the use of Bordeaux mixture (3-3-50), two or three applications usually being sufficient. The first application should follow very shortly after the blooming period is over or during the last of the bloom.

Avocado trees often become stunted, begin to die back and the leaves commence to curl up and drop off. This condition, called by the growers "die-back" or "leaf curl", is usually attributed to a fungus disease. The trouble is most common with trees on light dry land and in nearly all cases seems due to neglect or to overbearing rather than to the presence of any specific disease. When thoroughly mulched, watered and fertilized with stable manure or other fertilizer high in organic nitrogen, the sickly trees, if not too badly affected, usually make a quick recovery. When the trouble is due to unfavorable soil conditions, the recovery may not be permanent.

Some varieties, including Trapp, tend to bear when very young and need careful thinning to prevent weakening the trees. No fruit should be allowed to mature the first or second year. In the third season 10 to 20 fruits may be left to ripen on thrifty trees.

HARVESTING AND MARKETING

The main harvest season for the West Indian varieties extends from July to November; for the late Guatemalan and hybrid varieties, which make up the bulk of recent plantings, from November to March. The fruit is picked when full grown and mature, but before it begins to soften on the tree. It is then carefully graded and sized. The soft and imperfect fruit is discarded or used locally and only the firm, sound fruit is shipped. Great care should be taken in all these operations not to bruise or puncture the fruit as it has been found that such injuries are the cause of most of the decay in transit to market. When carefully picked, graded, and packed and promptly shipped, avocados carry in excellent condition from Florida to the most distant markets in the United States.

By using printed wrappers, customers should be instructed in the use of avocados and especially warned not to eat or serve the fruit until it is soft (not mushy) throughout. The attempt to eat an unripe avocado is not only disappointing but may be so distressing as to discourage any further purchases of this excellent fruit. The grower or shipper should market only fully developed fruit in proper condition to complete the ripening process. The attempt to salvage windfalls and premature drops will lead to disaster for both grower and consumer.

Formerly the standard package for avocados in Florida was the tomato crate. In recent seasons the "lug" box has almost entirely replaced other containers. Cushions of excelsior are used between the fruits to prevent bruising and fruits are generally wrapped in attractive, printed tissue wrappers.

Cold storage for periods of a month to six weeks is possible with some varieties, such as Trapp and Waldin, but the practice has not been developed in any large commercial way. It is usually adopted to meet some special demand.

CROPS, PRICES, AND PROFITS

The yield of mature trees varies so greatly, depending on the variety, the season, and the skill used in caring for the orchard, that no satisfactory yield averages can be given. Large seedling trees favorably located sometimes ripen several thousands of fruits in a single season but such yields must not be taken as an average to be expected in commercial plantings. Some of the best-cared-for Florida orchards average 3 to 5 crates to the tree annually, but owing to the selection of unfavorable sites or unprolific varieties, or to unskilled management and neglect, the average for all orchards is very low.

Prices received by the growers vary widely with the varieties grown and the season of shipment, ranging from 2 to 15 cents a pound net to the grower. Occasionally higher prices are received for fancy fruit used in special trade, but a return of 5 to 10 cents a pound would be a fair expectation in normal seasons during the late fall and winter months. Production costs also vary with soil types and locations, but an average cost of maintaining a bearing grove in thrifty condition may be placed at from \$75 to \$100 an acre per annum.

In both Florida and California cooperative associations have been organized and handle a large part of the fruit crop. As the industry developed it soon became evident that such associations were vitally necessary to standardize grades and packing methods, regulate movement of crop to market and increase sales through advertising and through wider distribution. An important feature of these cooperative associations is the field service afforded, advising growers on methods of fertilizing, spraying and general grove care.

There is little doubt that the avocado will eventually become an important and profitable crop in portions of Florida. Much still remains to be learned, however about cultural methods and varieties and the prospective investor should proceed with caution. A thorough personal investigation of the groves in Dade County and other localities where there are plantings will be an invaluable aid in planning a grove.

For the home fruit garden the avocado is well adapted. Small variety collections should be planted out in protected localities in Florida with a view to having this valuable food available through a good part of the year. With the rapidly increasing population, especially in winter, the local markets may well be as profitable as the distant centers of consumption.





